COMPLEX DYNAMICS OF MACROECONOMIC COLLAPSE AND ITS AFTERMATH IN TRANSITION ECONOMIES

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INTRODUCTION

The economic transition from planned command socialism to market capitalism has been unpredictable and complicated with a variety of divergent paths and outcomes emerging from the breakup and collapse of the former Soviet-led Council for Mutual Economic Assistance (CMEA) bloc.[1] Although social, political, and cultural factors played important roles in the actual collapse, an underlying factor was increasing economic stagnation, especially in the USSR. This led to reform efforts that led to actual economic decline, the breakup of the bloc, and systemic collapse [Rosser and Rosser, 1997a]. The unexpected and dramatically sudden nature of this collapse led Sargent [1993] to doubt the rational expectations hypothesis.

The reform efforts, which spread in various ways and rates to the various countries in the bloc, and had been going on for some time in China with increased economic growth, led to extremely sharp declines in economic activity among most of the former CMEA members in the aftermath of the bloc's breakup. In most countries a turnaround has occurred and growth has resumed, although not always in a fully stable manner. This process of sharp decline followed by an upturn has been labeled the "J-curve" effect [Brada and King, 1992]. A few countries, notably Poland, have recovered to the point that their per capita incomes have surpassed their precollapse levels. Most of these nations, however, have experienced political and social upheavals during this process, some with sharp changes in economic policies and extreme instabilities and oscillations. In almost all cases the process of transition has been marked by notable discontinuities and turbulence, with China being a partial exception.

Along with collapses in output, many also experienced outbreaks of hyperinflation for at least short periods of time. In addition, many, such as Russia and Ukraine, have seen sharp increases in income inequality whereas others, such as Slovakia,

have not. Finally, many have seen major increases in the relative size of the underground economy. It may be that these are linked phenomena, with a positive nonlinear feedback effect operating to make multiple equilibria exist. This helps explain the sharp divergences in performance that these countries have experienced.

In this paper we seek to partially explicate the varieties of these episodes of discontinuity and turbulence by considering some forms of complex nonlinear dynamics as applied to the stages of the systemic transition process.

COMPLEX DYNAMICS OF OUTPUT COLLAPSE DURING TRANSITION

The most dramatic economic aspect of the transition process has been the very sharp declines in output occurring in the former CMEA nations, declines predicted by few economists, most of whom were fairly optimistic about future prospects based on the historical experience in West Germany of the *Wirtschaftswunder* after 1948. At least two reasons why this experience was not repeated in the post-CMEA economies were the sharp initial shock to exports in all these states as the CMEA was dissolved and these economies were opened to competition with the market capitalist economies,[2] and the impact of the collapse of institutions.[3] In contrast, China's economy has not collapsed and has avoided both a shock to exports as it opened with the Dengist reforms and has avoided an institutional collapse as it gradually allowed market and capitalist institutions to emerge within the existing system.

We follow Rosser and Rosser [1997b] in modeling the decline of output after the initial shock to exports within a transitional labor market model of Aghion and Blanchard [1994], due to coordination failure arising from a phase transition within an interacting particle systems (IPS) model adapted from Brock [1993]. This is essentially the way institutional collapses are observed in most of the post-Soviet CMEA bloc countries, although not in China. The phase transition in the IPS model represents a qualitative change in the relations between the agents in the system, with the possibility of suddenly much worsened interactions between them leading to a sharp decline in the productivity of investment. The sharp decline in investment productivity thus leads to output decline and unemployment increases.

Following Aghion and Blanchard [1994], the total labor force equals 1, and that in the state sector equals E, initially equal to 1 also. That employed in the private sector equals N and the number unemployed equals U. After an initial shock, presumed due to the sudden decline of exports, $E < 1$ and $U > 0$. The marginal product of state workers is $x < y$, which is the marginal product of private sector workers. Taxes in both sectors per worker equal z, which pays for benefits per unemployed worker equal to b.

Letting w equal private sector wages, state sector workers capture quasirents equal to $q > 1$ with their wages determined by

$$(1) \qquad w(E) = qx - z.$$

State sector layoffs equal s, a policy variable, with no rehiring in that sector. Private sector job formation is given by

$$(2) \qquad dN/dt = a(y - z - w)$$

with the value of a being a function of the institutional framework of the economy and its resulting ability to coordinate signals, along with legal, property, financial, and regulatory institutions. Let H equal the number of private sector hires coming strictly from the unemployed, r be the interest rate, c be a constant difference between the "value of being (privately) employed," $V(N)$, and the "value of being unemployed," $V(U)$, the latter determined by an efficiency wage outcome. This gives private sector wages as

$$(3) \qquad w = b + c[r + (H/U)],$$

with the values of $V(N)$ and $V(U)$ given by arbitrage equations:

$$(4) \qquad V(N) = [W + dV(N)/dt]/r,$$

$$(5) \qquad V(U) = [b + c(H/U) + dV(U)/dt]/r.$$

Total unemployment benefits, Ub, are given by

$$(6) \qquad Ub = (1 - U)z.$$

The above imply a reduced form of private sector job formation given by

$$(7) \qquad dN/dt = a[U/(U + ca)]\{y - rc - [1/(1 - U)]b\} = f(U).$$

The dynamics represented by this equation are depicted in Figure 1 and depict conflicting impacts of unemployment upon private sector job formation. The first term in equation (7) reflects that downward wage pressure tends to stimulate job formation while the second term reflects that rising unemployment benefits raise taxes thereby depressing job formation. In Figure 1, U^* is the level of unemployment beyond which the depressive second term begins to outweigh the stimulative first term. In this figure we also see a level of s that implies two equilibria with $U1$ being stable and $U2$ unstable. If $U > U2$, the economy implodes to a condition of no private sector job formation.

The height of $f(U)$ in Figure 1 depends on the value of a. Thus, a discontinuous change in a could cause a discontinuous shift in $f(U)$. A discontinuous decline in a due to an institutional collapse could shift $f(U)$ to an $f(U')$ below the level of s. This could cause a destabilization of the formerly stable and low unemployment level of $U1$ and the implosion of the economy to the no private job formation equilibrium as depicted in Figure 2. The time pattern of unemployment in many transition economies is examined in Boeri and Terrell [2002] where sharp increases are recorded in many cases.

We now consider the dynamics of such a sudden decline in the value of a, following the IPS approach of Brock [1993], derived ultimately from Kac [1968]. Let there

FIGURE 1
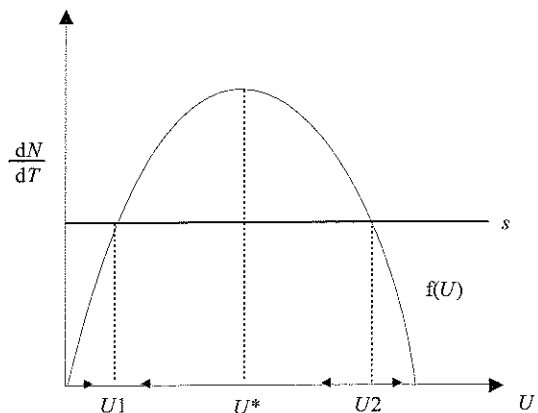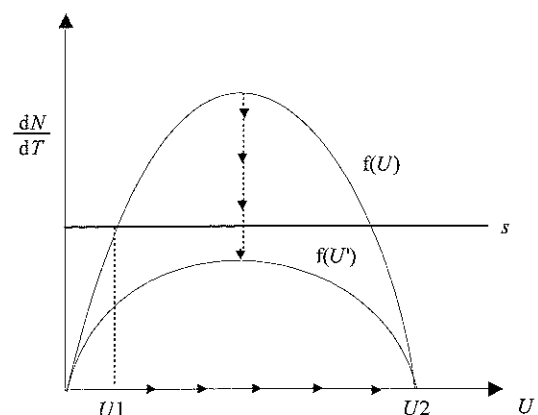**Private Sector Job Formation as Function of Unemployment Rate**

FIGURE 2
Change in Unemployment/Private Sector Job Formation Function

be F firms in the private sector,[4] existing within a fully specified web of mutual buyer-seller relations and production externality relations. Hiring by firms depends partly on discretely chosen attitudes from a possible set, K, each firm i having positive (optimistic) or negative (pessimistic) k_i. The strength of these k's depends on a continuous function, h, applying to all firms and varying over time, with their average equaling m. J is the average degree of interaction between firms, which can be viewed as a proxy for the degree of signal coordination or information transmission. The value of J will be closely tied to the institutional structure of the economy, with it likely to decline when there is an institutional collapse. β indicates "intensity of choice," a measure of how much firms are either optimistic or pessimistic, with 0 indicating random outcomes over the choice set.[5] The value of this is likely to be somewhat lower in the command socialist system with the choices of firms relatively constrained. Choices are $\varepsilon(k_i)$, stochastically distributed independently and identically extreme value.

FIGURE 3
Bifurcation of Interacting Particle Systems Model:
General Mood as Function of Intensity of Choice Times Connectedness
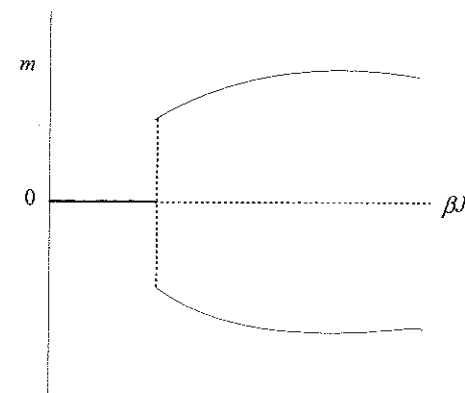
Assuming that direct net profitability per firm of hiring a worker is given by ($y-z-w$), not accounting for inter-firm externalities, then the net addition of jobs per firm is

$$(8) \qquad (dN/dt)/F = (y - z - w) + Jmk_i + hk_i + (1/\beta) e(k_i).$$

Substituting from equation (2) allows to solve for a as

$$(9) \qquad a = 1 + F\{[Jmk_i + hk_i + (1/\beta) e (k_i) (y - z - w)\}.$$

If there is an equal rate of interaction between firms, then m characterizes the set of k's and if the choice set is restricted to $(+1,-1)$, then Brock [1993, 2223] shows that

$$(10) \qquad M = \tanh(\beta Jm + \beta h),$$

where tanh is the hyperbolic tangent. βJ is a bifurcation parameter with a critical value = 1, as depicted in Figure 3.[6] If $\beta J < 1$ there is a single solution with the same sign as h. For $\beta J > 1$ there two discrete solutions, with $m(-) = -m(+)$. Thus a continuous change in either or both β or J could trigger a discontinuous change in a, with a decline in a being the scenario depicted in Figure 2 of a macroeconomic collapse. The variable a represents the influence of the institutional situation on the productivity of investment. A discontinuous drop in a thus triggers a drop in the productivity of investment that can lead to macroeconomic collapse. The collapse arises as the low productivity of private investment makes the private sector unable to absorb the workers being laid off in the state sector.

More than one story is possible within this model. Thus, for some cases the command planned system was in the upper-right branch of Figure 3 initially, reflecting a high degree of coordination within the system. As the degree of coordination declined

with the end of planning, the system moved to the branch to the left. Or alternatively it could be argued that it began on that branch, and then moved to the right with an increase in the intensity of choice of emerging private firms. But in the face of a lack of institutional support, they became pessimistic and dropped to the lower right branch in Figure 3. In effect we would expect, in the usual case, these two variables to be moving in opposite directions, with J declining as institutional disorganization arises, while β might be rising as firms become freer. Indeed, there could be a two-stage process whereby an economy moves from the upper-right branch to the left with the fall in J with disorganization and then moving to the lower-right branch as β rises but firms are pessimistic within the framework of the institutional collapse.

Yet a third scenario could be that just described, but where the firms become optimistic and jump to the upper-right branch. This scenario, implying a discontinuous upward leap in the growth rate, is consistent with what has happened in the Chinese case.[7] In this case there is no institutional collapse. The policy is to let the new system grow up "like mushrooms" around the base of the old system, which in turn remains in place, albeit becoming increasingly stagnant [Qian and Xu, 1993].

COMPLEX UNOFFICIAL ECONOMY DYNAMICS IN THE AFTERMATH OF COLLAPSE

Many transitional economies are moving beyond the kinds of collapse scenarios depicted in the previous section and are experiencing growth in conjunction with a process of privatization or restructuring of suddenly privatized firms, as new institutional frameworks emerge. Nevertheless, this process has seen numerous political backlashes as the numerous losers react against what is happening.[8] These upheavals have been exacerbated by extreme volatility and collapses in many of the newly emerging financial markets in these economies [Tamborski, 1995], Ahmed, Li, and Rosser [2002], Berglof and Bolton [2002] with the financial crisis in Russia in 1998 being the most extreme example. Closely connected to these political and financial problems has been the widespread growth of the unofficial economy in many of these economies.[9]

Just as the model of macroeconomic collapse in transition shown above relies upon labor market dynamics, likewise labor market dynamics provide an insight to the burgeoning increase of the unofficial economy in the transition economies. This increase complicates the effort to create functioning modern political economic systems as large unofficial sectors both reduce the tax revenues for the state and undermine the credibility and legitimacy of the system. Just as these sectors present a variety of problems for governments, however, in some cases they may also represent opportunities for the societies in question, especially when the governments are overly regulated or corrupt themselves, essentially just engines for the "grabbing hand" to operate [Shleifer and Vishny, 1998]. The unofficial economy may well be the locus where entrepreneurs create new development that will ultimately effectuate the transition process successfully, "bathtubs" containing both bath water and babies, to use the terminology of Asea [1996].

In any case an increasing literature suggests that what may be involved in the apparent increase in unofficial economies is the phenomenon of positive feedback with the attendant possibility of multiple equilibria. Most of this literature is somewhat informal, but nevertheless suggests that societies face two broad outcomes, a "good equilibrium" with a small unofficial sector and high tax revenues and a "bad equilibrium" with a large unofficial sector and low tax revenues [Johnson, Kaufmann, and Shleifer, 1997]. Putnam presents the contrast of northern versus southern Italy as a case in point, and links this example to that of the transition economies, remarking that "Palermo may represent the future of Moscow" [1993, 183].

Minniti [1995] has developed a model of membership in mafia organizations that draws on the positive feedback models of Arthur [1994]. Rosser, Rosser, and Ahmed [2003] adapt this model to analyze the labor market dynamics of the unofficial economy in transition. Agents are heterogeneous in their basic propensities to work in the unofficial economy. They all respond similarly, however, to changes in the percentage of output produced in the unofficial economy. At first there are increasing returns to working in the unofficial sector as law enforcement breaks down and it becomes more socially acceptable to work in this sector. Eventually however, this effect becomes saturated as competition between unofficial enterprises increases and the returns shift to a decreasing pattern.

These labor market dynamics can be described by

N = labor force,
N_u = proportion of labor force in unofficial sector,
r_j = the expected return to individual i of working in the unofficial sector minus that of working in the official sector,
a_j = the difference for individual j in returns to working in the unofficial sector minus those in the official sector based solely on personal characteristics, with this variable distributed evenly over the unit interval, $j \in [0,1]$, such that as j increases so does a_j, with a_0 the minimum and a_1 the maximum.

Let the difference in returns to an individual as a function of the share of the labor force in the unofficial sector be given by a cubic equation with positive parameters. Other forms could be used that would generate equivalent results, but the cubic does provide the proposed relation with first increasing and then decreasing returns to participating in the underground sector.

$$(11) \qquad\qquad f(N_u) = -\alpha N_u^3 + \beta N_u^2 + \gamma N_u.$$

A single individual's return will be

$$(12) \qquad\qquad r_j = a_j + f(N_u).$$

Figure 4 depicts the relative returns functions for three different individuals, each with different propensities to work in the unofficial economy.

Stochastic dynamics depend on the behavior of new entrants to the labor force, with $N' = N + 1$, $q(u)$ = probability that new labor force entrant will work in the

FIGURE 4
Probability for Three Different Agents of Working Unofficial Sector as Function of Unoffical Sector Share of Economy
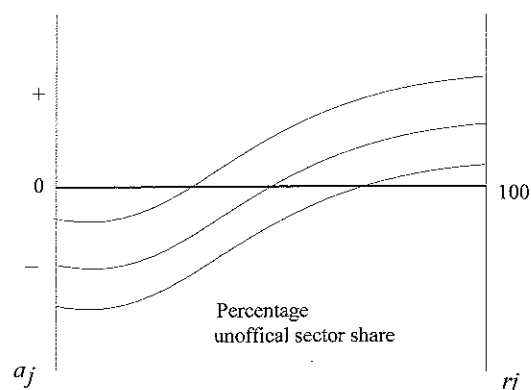
FIGURE 5
Shifts of Aggregate Probability of Working in Unofficial Sector a Function of Unofficial Sector Share
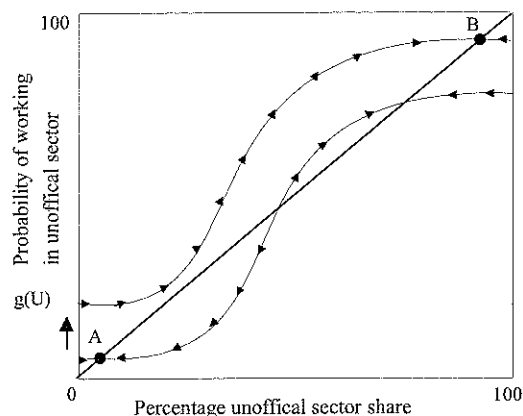
unofficial sector, $1 - q(u)$ = probability that new labor force entrant will work in the official sector, $\gamma_u = 1$ with probability $q(u)$ and $\gamma_u = 0$ with probability $1 - q(u)$.

Thus, the probability that a new labor force entrant will work in the unofficial sector is

$$(13) \qquad q(u) = [a_1 - f(N_u)] / (a_1 - a_0).$$

After the change in the labor force the size of the unofficial sector share of output will be

$$(14) \qquad N'_u = N_u + (1/N)[q(u) - N_u] + (1/N)[\lambda_u - q(u)],$$

with the stochastic third term on the right having an expected value of zero [Minniti, 1995, 40]. If $q(u) > N_u$ then the expected value of $N'_u > N_u$. This implies the possibility of three equilibria, the middle one unstable and the two outer ones stable. Figure 5 depicts a case in which an upward shift of all the a's leads to a jump from point A, a "good equilibrium" with a small unofficial sector, to point B, a "bad equilibrium" with a large unofficial sector. This could be what has happened in such dramatic cases as Russia and Ukraine where large increases in underground activity have been occurred.

We see such a shift being quite possible in the context of transition economies. The kind of decline of the macroeconomy discussed in the previous section could lead to such a shift as people become angry, alienated, and desperate. Rosser, Rosser, and Ahmed [2000] argue that such a shift could be brought about by an increase in income inequality. Again, social processes of alienation may be involved in such a shift. Furthermore, both of these effects may be exacerbated by hyperinflation. Arguably, reduced government regulations associated with a well-managed reform process could offset such effects.

Reliable empirical data on these matters is difficult to obtain, especially for the transition economies. The most widely used method for measuring the unofficial economy in transition is to examine electricity use, either in relation to measured GDP [Johnson, Kaufmann, and Shleifer, 1997] or as part of an estimated household electricity demand function [Lackó, 2000]. Both of these approaches are fraught with difficulties [Schneider and Enste, 2000], and just to show how great these difficulties are, Rosser, Rosser, and Ahmed [2003] find a negative correlation between these two sources for their estimates for transition economies.

Income distribution data are not as problematic as the unofficial economy estimates (which involve measuring that which people are actively seeking to conceal), but for the transition economies vary considerably for certain years. Rosser, Rosser, and Ahmed [2000] provide a detailed account of the various sources available, and Milanovic [1998] provides a good overview of the situation in the transition economies, documenting the large increases in inequality that have emerged in many of them, although a few have not seen such great changes.

Focusing on the years 1989 and 1994, and using the Johnson, Kaufmann, and Shleifer [1997] estimates of the size of the unofficial economy and a set of Gini coefficients estimated from various studies, Rosser, Rosser, and Ahmed [2000] found significant and positive correlations between the levels of these variables in 1994 and also between their changes from 1989 to 1994 for a set of 16 transition economies.

Rosser, Rosser, and Ahmed [2003] extend this study by adding two more countries (Kyrgyzstan and Slovenia) for which Lackó [2000] has data but Johnson, Kaufmann, and Shleifer [1997] do not.[10] Macroeconomic variables are brought in including the cumulative decline in measured GDP from 1989 to 1994 and the maximum rate of inflation experienced by a country during the transition [Fischer, Sahay, and Végh, 1996]. In addition, measures of economic freedom [de Melo and Gelb, 1996] and democratic rights in 1994 [Murrell, 1996] are included also.

Table 1 summarizes much of this data with UE being the share of the economy in the unofficial economy in 1994, ΔUE being the change in UE from 1989 to 1994,[11] GC is the Gini coefficient in 1994 and ΔGC is the change in the GC between 1989 and

TABLE 1
Economic Indicators for Selected Transition Economies

Country	Unofficial Econ Share	Change in Unoff Econ Share	Gini Coeff.	Change in Gini Coeff.	Cumulative GDP Decline	Max Rate Inflation	Unemployment Rate	Economic Freedom	Democratic Rights
Belarus	15.0	-0.4	.248	.014	38.9	1994.0	2.1	37	50
Bulgaria	29.5	6.7	.340	.110	20.7	338.8	13.0	73	83
Czech Republic	17.2	11.2	.239	.035	10.2	52.1	3.2	90	92
Estonia	24.6	5.7	.392	.127	29.2	946.7	8.1	90	75
Georgia	62.2	37.7	.560	.270	37.1	8273.5	2.0	37	83
Hungary	28.1	1.1	.243	.020	17.2	34.6	11.0	87	92
Kazakhstan	30.6	13.6	.328	.053	37.6	2566.6	1.0	40	25
Kyrgyzstan	39.2	16.3	.553	.293	34.3	1365.6	0.7	77	58
Latvia	32.6	19.8	.270	.018	32.2	958.2	6.4	80	75
Lithuania	30.2	18.9	.348	.100	42.2	1162.6	3.8	83	83
Moldova	36.8	18.7	.360	.111	41.9	2198.4	1.2	57	50
Poland	15.8	0.1	.310	.045	17.7	639.6	16.0	87	83
Romania	16.9	-5.4	.278	.048	31.8	295.5	11.0	73	58
Russia	38.5	23.8	.446	.186	24.5	2510.4	2.2	67	58
Slovakia	15.4	9.4	.200	.000	15.7	58.3	15.0	87	75
Slovenia	25.0	-1.7	.251	.036	18.5	246.7	14.5	83	92
Ukraine	41.8	25.5	.330	.098	26.5	10155.0	0.3	27	58
Uzbekistan	9.8	-1.6	.330	.038	17.2	1232.8	0.3	43	25

TABLE 2
Regression with Relative Size of Unofficial Economy as Dependent Variable

Variable	Coefficient	Stand. Error	t-statistic	Probability
Constant	−21.90567	12.72	−1.72	0.11
Econ. Freedom	0.064869	0.26	0.25	0.81
Cum. GDP Decline	0.300347	0.21	1.42	0.18
Inflation Rate	0.002819	0.001	2.12	0.058[b]
Dem. Rights	0.153659	0.19	0.79	0.44
Unemp. Rate	0.075561	0.46	0.16	0.87
Gini Coefficient	64.73212	27.32	2.37	0.037[a]

$R^2 = 0.80$
F-statistic = 7.24
Probability F-statistic = 0.0025

a. Significant at the 5 percent level;   b. Significant at the 10 percent level.

TABLE 3
Regression with Change in Unofficial Economy as Dependent Variable

Variable	Coefficient	Stand. Error	t-statistic	Probability
Constant	−22.57	13.51	−1.67	0.12
Econ. Freedom	0.43	0.26	1.68	0.12
Cum. GDP Decline	0.17	0.21	0.81	0.43
Inflation Rate	0.004	0.001	2.97	0.013[a]
Dem. Rights	−0.074	0.18	−0.41	0.69
Gini Coef. Change	14.67	30.46	0.48	0.64
Unemp. Rate	−0.74	0.46	−1.60	0.14

$R^2 = 0.75$
F-statistic = 5.57
Probability F-statistic = 0.0071

a. Significant almost at the 1 percent level.

1994 as reported in Rosser, Rosser, and Ahmed [2000],[12] ACD is cumulative GDP decline from 1989 to 1994 adjusted for the change in the unreported unofficial economic activity, IR is maximum annual inflation rate experienced during transition, UR is the unemployment rate, EF is economic freedom index, and DR is democratic rights index ranging from 0–100, the sources for all these listed above.

Tables 2 and 3 are taken from Rosser, Rosser, and Ahmed [2003]. They respectively show the size of the unofficial economy as a function of the above variables, except for the change variables and the change in the unofficial economy as a function of the above variables except for the level of the unofficial economy and the level of the Gini coefficient. That paper shows other regression results as well. It also discusses the numerous caveats that must be recognized in interpreting these results, which must be viewed with great caution for numerous reasons.[13]

Table 2 easily shows that the Gini coefficient is the only variable significant at the 5 percent level in the relation with the size of the unofficial economy, with the maximum inflation rate significant at the 10 percent level, and no others individually significant. Both of the significant variables are positively correlated with the size of the unofficial economy, with both variable coefficients "economically large". From Table 3 it is easily seen that only the maximum inflation rate is significant at any level, being so at almost the 1 percent level, and it is positively correlated.

What is perhaps more surprising is that the measures of economic freedom and democratic rights do not appear to be significantly correlated with the unofficial economy in any of the formulations. Both reformed and unreformed transition economies have large as well as small unofficial economies. Relatively reformed economies with large unofficial sectors include Latvia and Lithuania while Belarus is an example of a relatively unreformed economy with a small unofficial sector.

In any case, these results support the idea that the turbulent and dramatic macroeconomic changes in the transition economies altered the socioeconomic environment in such a way as to bring about the kind of shift depicted in Figure 5 that would explain a dramatic increase in the size of the unofficial sector in such economies. Such increases most definitely have been observed, with such countries as Russia, Ukraine, and Georgia more than doubling their unofficial sector shares in those five years.

CONCLUSIONS

Many analysts of systemic transition posit a unilinear process from planned command socialism to laissez faire market capitalism, especially policymakers at international financial institutions. Countries are grouped according to indexes of reform which are then posited to explain most important aspects of the economies in question [de Melo and Gelb, 1996]. The usual lesson of such exercises is that "big bang" ("shock therapy") liberalization is to be encouraged. The relatively good condition of some countries that rank high on this index is emphasized.

The transition process, however, is a complex one in many ways with numerous potential pitfalls lying along this path, as the sudden appearance of financial crisis in the Czech Republic reminds us. Maintaining some kind of stability during this difficult dynamic may be more important than achieving some high score on some artificially constructed index.

Poland has held back on certain aspects in order to maintain some stability. This holding back has brought criticism, yet Poland's widely proclaimed success may well have depended upon it, even as successive elections have seen incumbents removed there. Poland has been slow to privatize major state-owned enterprises, many of which have been surprisingly successful in international trade [Kamiński, Kwieciński, and Michalek, 1993]. And the arguably most successful of all transitional economies, China, has been notable for the gradualism of its approach, which has not put it at the far end of the liberalization index, although it may also face major crises in the future.

Indeed, what is striking is the considerable diversity of outcomes and paths that we observe. Certainly there was diversity before the process began, with China differing in many ways from the European CMEA nations, which varied from more strongly centrally controlled Czechoslovakia to relatively market-oriented Hungary. But the

observable differences between the economic performances among these nations far outweigh any other inter-country variations in recent years: from the Chinese super-growth to nations with sharply declining output, with inflation rates ranging from single digits to the thousands of percents per year, from nations such as Slovakia whose income distribution remains unchanged as perhaps the most equal in the world to Georgia whose income distribution has become among the most unequal in the entire world. The variation in the size and changes in the unofficial economy are also very striking.

We have sought to provide some reasons why we might observe such sharply divergent outcomes from a broadly similar process of transition. With the ending of the former system and the ending of its institutional framework in the context of a collapse of international trade, these economies faced sharply divergent scenarios of transition depending on signal coordination and the decision making of newly forming firms that could lead to successful and even rapid growth or to deep implosion and depression as critical phase transitions are passed. These collapses, along with the emergence of hyperinflation and increased income inequality, have fed into social alienation and the movement of economic activities into the unreported underground sector, thus making tax collection more difficult and further exacerbating both macroeconomic and social-political problems and conflicts.

All this suggests that caution is in order for analysts prescribing policies for these countries. Nations that have attempted to avoid any changes in the circumstance of a collapsed international system have experienced severe economic difficulties. But, in the face of extreme political and economic instability and turbulence, a healthy concern for maintaining some stabilizing elements within the process of transition is reasonable.[14] Indeed, this is exactly what the most successful of these transitional economies have done.

NOTES

1. Overviews of alternative paths among transition economies are provided in Murrell [1996], de Melo and Gelb [1996], Svejnar [2002], and Rosser and Rosser [2004]. The special growth path of China is documented in Maddison [1998].
2. For discussion of trade patterns and reform policies in the former Soviet Union, see Rosser [1993].
3. Those emphasizing the roles of institutional collapse, information transmission problems, and the formation of appropriate incentive structures within the nascent market economies incude Murrell [1991], Ellman [1994], Kornai [1994], and Stiglitz [1994]. Calvo and Corricelli [1992] focus on the non-functioning of credit institutions. Blanchard and Kremer [1999] document the role of general disorganization.
4. F is assumed to be constant, possible as we allow "potential" firms to have zero output.
5. In the original IPS literature β is "temperature" [Kac, 1981], with critical values associated with phase transitions in material states such as melting or magnetization.
6. Figure 3 does not precisely resemble its equivalent in Rosser and Rosser [1997b], which was incorrect. The correct version first appeared in Rosser [1999] and is shown here.

7. Such a contrast between self-fulfilling optimistic and pessimistic scenarios within privatizing transition economies has been studied using game theory by Laban and Wolf [1993].

8. Rosser and Rosser [1996] expand this model of macroeconomic collapse to endogenous state policy on layoffs in the state-owned sector and show possibilities of many varieties of complex phenomena.

9. Schneider and Enste [2000] provide a thorough overview of issues related to defining and measuring unofficial economies, as well as the implications of their growth. Other terms used for this sector include shadow, informal, underground, irregular, subterranean, black, hidden, and occult. They are all characterized by not being reported to government authorities and thus have no taxes paid on them.

10. This set of countries does not include China for which no estimates of the size of its unofficial sector have been made. However, corruption is reportedly rampant, and there has been a substantial increase in income inequality over time both regionally and between classes [Riskin, Zhao, and Li, 2001].

11. For some countries some of these years are different by one in one direction or another due to data difficulties.

12. The Ginis for Kygyzstan and Slovenia are from Milanovic [1998]. As in footnote 11, some of the years differ slightly from those listed due to data difficulties.

13. These empirical results must be viewed with caution. When the same regressions were run using just the Lackó [2000] estimates for the unofficial economy, no significant relationships were found at all.

14. Rosser and Rosser [2001] further discuss the policy issues in relation to the "Washington Consensus".

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